A re-evaluation of the fossil human calvaria from Singa, Sudan

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Synopsis

The first studies of the Singa calvaria concluded that it was an Upper Pleistocene 'proto-Bushman' fossil. More recently it has been suggested that it is a 'neanderthaloid' specimen or an anatomically modern specimen. This study concludes that the Singa calvaria is an unusual archaic *Homo sapiens* fossil, perhaps most closely related to the crania from Djebel Irhoud.

Introduction

The Singa calvaria (Fig. 1) was discovered by W. G. R. Bond in 1924, eroding from a caliche deposit within the 'Gezira clay' exposed in the west bank of the Blue Nile (Oakley, Campbell & Molleson 1977). The discovery was made in the Singa district of eastern Sudan, about 320 km south-east of Khartoum, and faunal and archaeological remains were also recovered, both at the Singa site and the related site of Abu Hugar, about 15 km further south (upstream). The collection of faunal material contained some extinct species including an antilopine, a porcupine (*Hystrix astasobae* Bate 1951) and a bovine allocated by Bate to *Homoioceras singae* Bate 1949 (Bate 1951). The allocation of the bovine fossils from Singa and Abu Hugar to an extinct species of long-horned buffalo has recently been questioned, and it appears probable that the holotype skull from Singa belongs to a short-horned buffalo (Gentry & Gentry 1978). Nevertheless, Bate's conclusion that the fauna from Singa and Abu Hugar is of Upper Pleistocene age, and perhaps dates from an earlier phase of the Upper Pleistocene, still stands (Bate 1951).

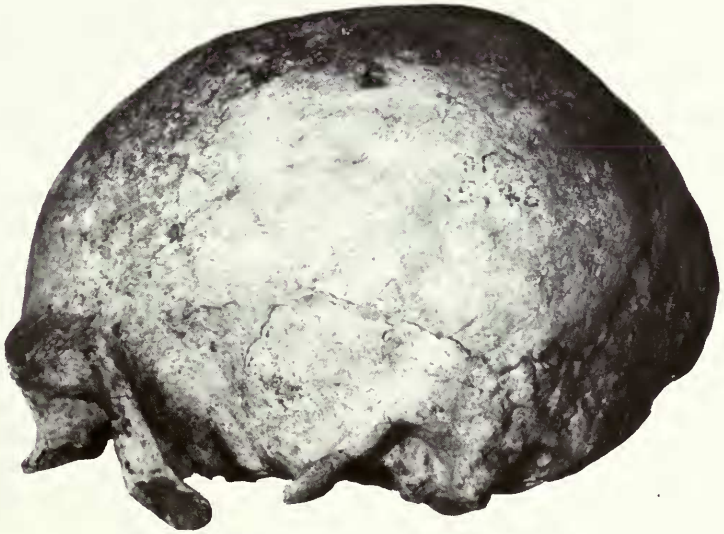

Fig. 1. Left lateral view of the Singa calvaria. BM(NH) Anthropology registration number M 15546. × ½.

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Lacaille (1951) considered that the Singa and Abu Hugar implements had most affinity with the Middle Stone Age Proto-Stillbay industry of Lochard, Rhodesia, which would indicate on present dating evidence an earlier Upper Pleistocene age. However, Marks (1968) cautioned that the artefacts were nondescript, and although found in the same layer as the calvaria, were not necessarily of the same age. He agreed with Lacaille that some of the flakes might be 'Levallois' but remarked that Levallois flakes occurred in a variety of African Middle and Late Stone Age industries of widely-differing ages. He also commented that there were no grounds for comparison of the Singa artefacts with the Khormusan Levalloiso-Mousterian industry known from the Nile region. However, McBurney (1977) quoted a range of radiocarbon dates for the Khormusan from over 43 000 years BP (before present) to less than 20 000 years BP and suggested that the Singa calvaria might represent the population which produced what he considered to be 'the latest expression of the Mousterian so far known in the world'. Whiteman submitted a crocodile tooth from Abu Hugar for radiocarbon dating, which produced an age of 17 300±2 000 years BP. Whiteman and Oakley considered that this late Pleistocene radiocarbon age might be due to contamination from the limestone in the Abu Hugar deposit or from the river Nile which regularly flooded its banks in the area (Whiteman 1971). The relatively low radiocarbon age is also inconsistent with relative dating analyses which apparently confirmed the association of the Singa calvaria and the Abu Hugar fauna, but revealed that the bones contained only a negligible amount of collagen (Oakley *et al.* 1977).

Review of previous studies of the Singa calvaria

The first description of the Singa calvaria was published by Woodward (1938), who concluded that the specimen was a brachycephalic variant of the 'Boskop type' of *Homo sapiens* known from the later Pleistocene of southern Africa. Modern Khoisan (Bushman) populations were regarded by Woodward as 'degenerate' survivors of this Boskop race. Wells (1951) compared the Singa calvaria with a wider range of Upper Pleistocene hominids, but similarly concluded that the Singa fossil was a north African variant of the proto-Bushman stock already known from sites such as Boskop and Matjes River. Briggs (1955) accepted its pre-Bushman affinities but also suggested that the Singa calvaria was comparable to the 'type C' male crania from the late Pleistocene/Holocene site of Afalou in Algeria. Anderson (1968) discounted any relationship between the Singa fossil and populations such as those represented at Afalou, and he emphasized that the latter groups were instead clearly linked to European Upper Palaeolithic and Mesolithic populations. A similar view was taken by Greene & Armelagos (1972), who compared the Singa calvaria with the Wadi Halfa Mesolithic crania from northern Sudan. They also saw little resemblance between the Singa fossil and 'boskopoid' and 'bushmanoid' fossils from southern Africa. However, Wells (1972) reasserted that such a relationship existed, and suggested that the Singa fossil might be a paedomorphic descendant of the earlier Upper Pleistocene Omo (Kibish) population.

Tobias, however, noted that the supposed 'bushmanoid' characters of the Singa specimen were restricted to the rear of the vault, whereas the anterior part of the calvaria was more archaic, even resembling the Broken Hill cranium in certain details (Tobias 1968). In a more extensive study, Brothwell (1974) also questioned the Khoisan features of the Singa fossil and suggested that its unusual cranial shape might be the result of a longitudinal growth defect affecting the parietal bones, producing a cranial shape which superficially resembled that of Bushman skulls. The cranial contours of the Singa specimen were compared to those of other Pleistocene crania, and the comparisons suggested that the Singa calvaria most resembled archaic (i.e. not anatomically modern) *Homo sapiens* fossils such as the Gibraltar neanderthal cranium. Brothwell's data on cranial measurements were used in a multivariate principal component analysis conducted by Andrews, and the Singa specimen was placed as very distinct from various fossil and Recent Bushman crania as well as from a small sample of other Recent African crania (Brothwell 1974). Instead the analysis linked it with the Broken Hill cranium, but this was the only archaic *Homo sapiens* fossil included in the analysis from a range of relevant specimens. Brothwell concluded that the overall cranial morphology of the Singa calvaria lay closer to that of early Upper

Pleistocene crania from Europe, Asia and Africa than to late Pleistocene and Recent Khoisan specimens. He also suggested that the Singa fossil might represent a hybrid of 'neanderthaloid' and anatomically modern populations. However, Rightmire (1975) stated that in his view the Singa calvaria was not 'neanderthaloid' nor closely related to proto-Bushman or Bushman material from southern Africa. He agreed with Wells (1972) that it might be related to the Omo (Kibish) material, but concluded that it was probably a late Pleistocene example of robust but anatomically modern man.

A new study of the Singa calvaria

None of the studies of the Singa specimen have compared it in both metrical and morphological characteristics with a full range of relevant Upper Pleistocene crania as well as a range of more recent African material. In a multivariate study of Middle and Upper Pleistocene hominid crania using Mahalanobis' generalized distance statistic (D^2) (Rao 1952 : 246), the Singa calvaria was compared with a wide range of other fossil crania (Stringer 1974). It was concluded that the specimen was not closely related metrically to modern *Homo sapiens*, but instead was more similar to the *Homo erectus* fossils from Ngandong (Java) and to archaic *Homo sapiens* crania such as the Broken Hill fossil and the European and south-west Asian Neanderthals. However, at that time it was not possible to use, in comparison, data from certain relevant fossil crania nor from large samples of Recent African populations (including Bushmen). Additionally, the multivariate analyses used by Brothwell (1974) and myself (Stringer 1974) had not distinguished factors of size from those of shape in assessing multivariate distances. The size and shape statistic of Penrose (1954) does allow such distinctions to be made whilst accurately reflecting true differences in size and shape (Corruccini 1973). This method of analysis is utilized here, modified by the use of logarithms of the raw cranial data rather than standardized data. This approach can be shown on theoretical and empirical grounds to give a shape distance which more truly reflects proportional change in shape, and it also avoids the problem of standardizing data from small or metrically divergent samples.

The computation of the Penrose size and shape statistic in the case for P variables is based on the equation

$$\underset{\substack{\text{total}\\ \text{distance}}}{\frac{1}{P}\sum d_i^2} = \underset{\text{size}}{\bar{d}^2} + \underset{\text{shape}}{\frac{1}{P}\sum (d_i - \bar{d})^2}$$

where $d_i = X_i - X_i'$, X_i refers to log i^{th} measure on the Singa calvaria and X_i' to log i^{th} measure on another specimen or group. The total distance and size distance are calculated, and the shape distance is obtained by subtraction. Size distances which were negative before squaring are plotted separately in the results from those which were positive.

Eleven cranial measurements (glabello-occipital length, maximum cranial breadth across parietals, bistephanic, biauricular and biasterionic breadths, frontal chord and subtense, parietal chord and subtense, and occipital chord and subtense) were taken on a range of Middle and Upper Pleistocene crania (samples generally as Stringer 1974). It was also possible to include for the first time comparative cranial data from the south-west Asian Upper Pleistocene sites of Qafzeh (where I have combined data from crania 6 and 9 with data from the comparable Skhul 5 specimen) and Shanidar (where I have combined data from Shanidar 1 with data from the comparable Amud 1 fossil to form an Asian Neanderthal group). Data from the robust Achegour 1 Mesolithic cranium were also included as this was representative of a late Pleistocene/early Holocene mid-Saharan population (Oakley *et al.* 1977). Large comparative samples of Recent African male and female crania were also included (sample size for each sex numbered between 34 and 58 individuals) using data collected by Howells (1973). However, it was not possible to use comparative data from the Sudanese Wadi Halfa Mesolithic crania (Greene & Armelagos 1972) since a different series of measurements were taken.

The results of the size and shape analysis with the Singa calvaria as reference specimen are displayed in Fig. 2. It can be seen that the specimens and populations generally regarded as 'anatomically modern' are all very distinct in shape from the Singa fossil, although Bushman crania are closest to it of the Recent groups. Omo (Kibish) 1 and the Asian Neanderthal sample are also quite distant from the Singa specimen. However, the *Homo erectus* samples from Peking (Choukoutien) and Ngandong (Java), the archaic *Homo sapiens* crania from Djebel Irhoud, Saccopastore, Broken Hill and Omo (Kibish) 2, and the European Neanderthals, are all relatively close to the Singa calvaria in shape. Thus the Singa specimen apparently displays metrical features of *Homo erectus* and archaic *Homo sapiens*.

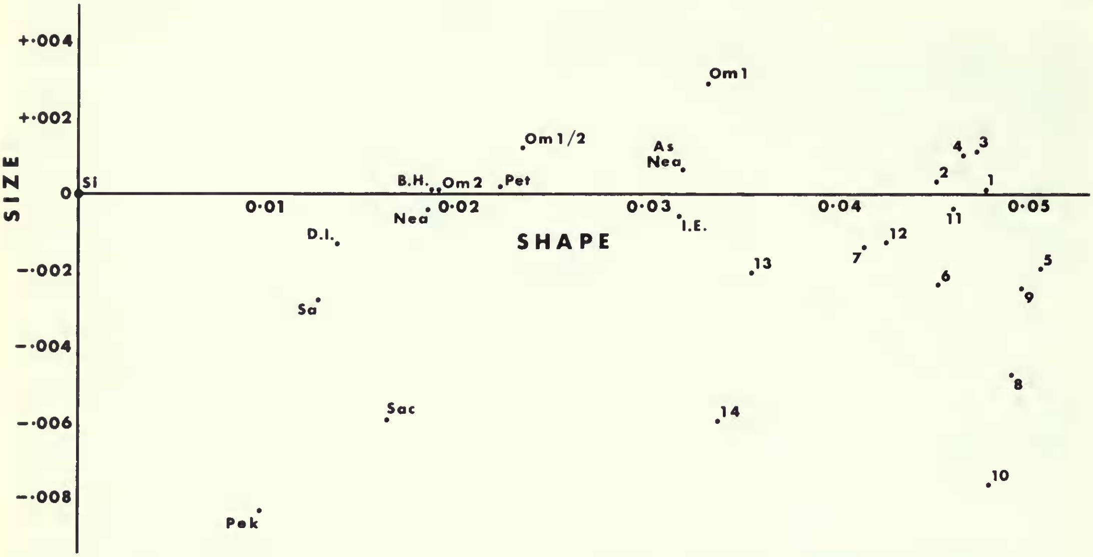

Fig. 2. Result of Penrose size and shape analysis using Singa calvaria as reference specimen. 1 – Qafzeh 6, 9 and Skhul 5; 2 – European Upper Palaeolithic group; 3 – North African Mesolithic group; 4 – Achegour (Niger); 5, 6, male and female Egyptian; 7, 8, male and female Teita (Kenya); 9, 10, male and female Dogon (Mali); 11, 12, male and female Zulu; 13, 14, male and female Bushman. Si – Singa; D.I. – Djebel Irhoud 1; So – 4 Ngandong (Solo) crania; Pek – 4 Peking (Choukoutien) crania; Sac – Saccopastore 1; Nea – European Neanderthal group; B.H. – Broken Hill; Om – Omo (Kibish) crania, treated separately and as a group; Pet – Petralona; As Nea – Amud 1 and Shanidar 1; I.E. – Iwo Eleru (Nigeria).

Any attempt to classify the Singa fossil must take into account morphological, as well as metrical, characteristics. The shape analysis (Fig. 2) could not accurately reflect overall cranial morphology since the data employed are predominantly measured lengths of chords and subtenses in the sagittal plane and breadths of the lower part of the cranial vault. Shape resemblance between the Singa and *Homo erectus* specimens is a reflection of a short, relatively low cranial vault, broad at the base, a very short, flat parietal arch, and a protruding occipital bone. Differences in shape are primarily caused by the larger occipital chord, parietal breadth and frontal dimensions of the Singa fossil. The much greater size of the Singa fossil is particularly marked in comparison with the Peking *Homo erectus* crania (Fig. 2). This is obviously related to the greater cranial volume of the Singa specimen. Previous estimates of the cranial capacity of the Singa fossil calculated from external measurements ranged from 1550 to 1600 ml (Wells 1951) and my own calculations confirm these figures. Using millet seed to measure the endocranial volume not occupied by matrix gave a value of approximately 1100 ml, and examination of radiographs suggests that there is at least 300 ml of matrix remaining within the calvaria. It is hoped that the endocranial surface can eventually be cleaned to obtain a better estimate of endocranial volume, but it is clear that the cranial capacity of the Singa specimen lies well outside the range of 915–1255 ml measured for eleven of the Peking and Ngandong crania (Day 1977). The Singa calvaria also differs from *Homo erectus* crania in a whole range of morphological features. The supra-orbital torus in the Singa fossil is strongly developed laterally but does not form a thick continuous structure. The occipital bone, although projecting, is not strongly angulated, and the occipital plane is long compared to the nuchal plane, which is poorly defined. The occipital torus conforms to the *Homo sapiens* pattern, and those measurements of occipital and parietal thickness which can be taken fall within the range of values for *Homo sapiens* rather than for *Homo erectus*. Additionally the cranial vault displays none of the angularity and sagittal keeling characteristic of *Homo erectus* and Middle Pleistocene archaic *Homo sapiens* crania.

In a recent study of Pleistocene hominids I investigated the use of angles and indices as a means of discriminating between *Homo erectus*, archaic *Homo sapiens* and anatomically modern *Homo sapiens* crania (Stringer 1978). Although there was often an overlap in ranges of values between the groups, it was usually possible to assign isolated specimens to one or other of these groups on the basis of their cranial angles and indices. Table 1 shows which angles and indices could be determined for the Singa calvaria, and the group ranges within which the values for the Singa specimen fall (indicated by +). The nasio-frontal angle which measures the medial projection of the upper face shows no discrimination in this case, but the other values appear to indicate a resemblance to archaic *Homo sapiens* crania. The only exception, the low value for the bregma angle, is related to the relatively short basion–nasion length of the Singa calvaria. However, a relatively short basion–nasion length is also found in the Broken Hill cranium which has the lowest value for the bregma angle found in archaic *Homo sapiens* crania, and which also falls within the modern range of values for this angle. It seems certain that the Djebel Irhoud 1 fossil (which lacks the basion) would also have had a similarly low value for the bregma angle, suggesting that the Singa calvaria is in fact close to African archaic *Homo sapiens* crania in this feature.

Table 1. Classification of the Singa calvaria using ranges of variation in angles and indices for Pleistocene fossil hominid crania (position of Singa indicated by +)

	Nasiofrontal angle	Bregma angle	Nasion–bregma angle	Frontal angle	Parietal angle	Occipital angle	Bregma–asterion chord / Biasterionic breadth
Homo erectus (Peking and Ngandong)	+				+	+	+
Archaic *Homo sapiens* (includes Petralona, Broken Hill and Neanderthals)	+		+	+	+	+	+
Anatomically modern *Homo sapiens* (includes Qafzeh and Skhul)	+	+		+			

There are other characteristics in which the Singa calvaria resembles archaic rather than anatomically modern *Homo sapiens*. The temporal bone is relatively low and robust, the supra-orbital torus is broad and well-developed laterally and the interorbital area and malars are strongly built (Tobias 1968, Brothwell 1974 and my own observations). The mastoid processes are small and there is a well-developed occipitomastoid crest, as in many archaic *Homo sapiens* crania (Stewart 1964). But on the other hand the height of the occipital plane compared to the length of the nuchal plane is relatively large, as in anatomically modern *Homo sapiens*.

Combining the metrical and morphological data given here it seems likely that Tobias (1968) and Brothwell (1974) are correct in questioning the proto-Bushman and modern affinities attributed to the Singa fossil. It is probably a relatively late archaic *Homo sapiens* specimen with an unusually short parietal arch which has affected the overall cranial shape (Brothwell 1974). Its affinities are more likely to lie with late archaic *Homo sapiens* fossils such as those from Omo (Kibish) and Djebel Irhoud rather than with earlier specimens such as the Broken Hill cranium. Whilst there seem to be no Upper Pleistocene crania which match the Singa calvaria closely in metrical characteristics it may be significant that the Djebel Irhoud 1 specimen is closest in overall Penrose (1954) distance (size+shape) to the Singa fossil. Both Djebel Irhoud 1 and the second specimen from the site are short broad crania with high frontal bones and relatively small brows compared with many other archaic *Homo sapiens* crania (Ennouchi 1968). Like the Singa fossil they also have relatively short deep infratemporal fossae, small mastoid processes and a large cranial capacity. It seems possible that the Singa calvaria in fact represents an unusual individual specimen drawn from a comparable archaic *Homo sapiens* population which lived in Sudan during the Upper Pleistocene.

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